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(54) **Oil filter unit and motorcycle including the oil filter unit**

(57) An adaptor 30 for attaching an oil filter 10 to a crank case 11 has a first attachment surface 30a on the crank case 11 side and a second attachment surface 30b on the oil filter side. The first attachment surface 30a has first and second closed areas 31 and 32 separated from each other by a portioning wall 35. The second attachment surface 30b has an oil inlet port 33 and an oil outlet port 34. The oil inlet port 33 and the oil outlet port 34 communicate with the first closed area 31 and the second closed area 32, respectively, via their own communication paths. The adaptor 30 is attached to the crank case 11 such that an oil supply port 23 formed on the crank case 11 is positioned within the first closed area 31 and that an oil return port 24 formed on the crank case 11 is positioned within the second closed area 32.

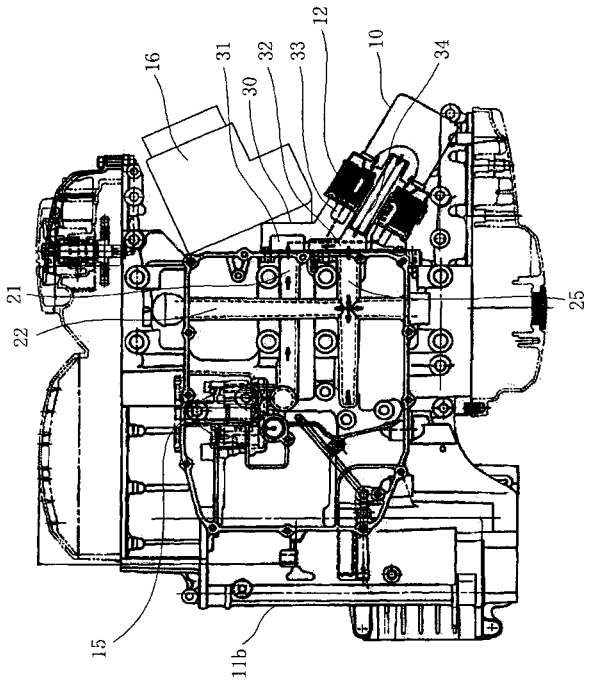

FIG. 3

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to an oil filter unit of a motorcycle, and a motorcycle including the oil filter unit.

BACKGROUND TO THE INVENTION

[0002] A number of metal components, such as cylinder walls, pistons and transmission components, which move at high speed while contacting one another are contained within an engine of a motorcycle. Thus, lubricating oil is supplied to the respective components using a lubricating device so as to reduce frictional resistance caused by the respective components and obtain sufficient functions from the engine.

[0003] According to a typical route of lubricating oil supplied from a lubricating device, lubricating oil stored in an oil pan disposed below a crank case of an engine is pressurized or pumped up using an oil pump and filtered by an oil filter. After passing through a main gallery provided within the crank case, the lubricating oil is supplied with pressure to the respective lubrication sections.

[0004] The oil passages extending from the oil pump to the main gallery are so disposed as to intersect one another at right angles for the structural reasons of the crank case. Thus, the attachment face of the oil filter is generally so positioned as to intersect the oil route defined by the oil passages at right angles (for example, see JP-A-2004-204771).

[0005] In some arrangements of the oil pump and attachment positions of the oil filter, however, a number of communication passages are required to complete or connect the oil passages. As a result, the number of manufacturing steps necessary for forming the oil passages and communication passages of the crank case increases, and thus the cost rises.

[0006] Similarly to the oil passages, the communication passages are so disposed as to intersect one another at right angles for the structural reasons of the crank case. It is therefore necessary to dispose the communication passages such that no interference is caused between the communication passages and the oil passages. Such an arrangement increases the oil route length and thus lowers the oil pressure in some cases.

[0007] A method disclosed in JP-A-2001-227317 simplifies the structure of the oil passages considering these limitations in layout. Figs. 7 (a) and 7 (b) of the accompanying drawings show a structure of an engine crank case as shown in JP-A-2001-227317. Fig. 7 (a) is a left side cross-sectional view, and Fig. 7 (b) is a right side cross-sectional view of an engine crank case shown in JP-A-2001-227317.

[0008] As illustrated in Figs. 7 (a) and 7(b), an engine case 101 is constituted by an upper engine case 101a and a lower engine case 101b. An oil pan 108 is attached to the lower part of the lower engine case 101b. Lubricating oil within the oil pan 108 is pumped up by an oil pump 102, and is supplied with pressure from an oil delivery passage 103 to an oil filter 105. Then, the lubricating oil filtered by the oil filter passes through a communication path 104 and through an oil supply passage 106 and is guided to a main gallery 107. Thereafter, the lubricating oil flows through other oil supply passages (not shown) to be introduced to the respective lubrication sections within the engine.

[0009] In this structure, the oil delivery passage 103 and the oil supply passage 106 are disposed parallel with the connection plane between the upper engine case 101a and the lower engine case 101b, and the communication path 104 is disposed parallel with the connection plane between the lower engine case 101b and the oil pan 108. In this layout, the communication path 104 is not parallel with the oil delivery passage 103 and the oil supply passage 106 and thus do not interfere with the oil delivery passage 103 and the oil supply passage 106. Thus, the distance between the communication path 104 and the oil filter 105 can be decreased to the minimum length.

[0010] According to the layout of the oil passages and the communication path provided within the engine crank case disclosed in JP-A-2001-227317, the respective oil passages extending from the oil pump to the main gallery are so disposed as to intersect one another at right angles. However, the communication path extending from the oil filter to the oil supply passage does not intersect or cross the oil passages at right angles. Therefore, this structure is effective in that the communication path can be disposed without causing interference with the oil passages in view of the layout of the communication path. However, considering the structure of the engine crank case, it is extremely difficult to manufacture a communication path which does not intersect or cross the oil passages at right angles. Therefore, the manufacturing cost considerably rises.

[0011] It is an object of embodiments of the invention to provide an oil filter unit capable of forming oil passages at low manufacturing cost regardless of the attachment position of an oil filter.

SUMMARY OF THE INVENTION

[0012] An oil filter unit according to one embodiment of the invention includes an oil filter, and an adaptor for attaching the oil filter to an attachment seating surface of a crank case. The adaptor has a first attachment surface to be attached to the attachment seating surface of the crank case and a second attachment surface to be attached to the oil filter. The first attachment surface has a first closed area and a second closed area separated from each other by a portioning wall. The second attachment surface has an oil inlet port through which oil is introduced from an oil pump and an oil outlet port through which oil is discharged to an oil passage formed in the

crank case. The oil inlet port communicates with the first closed area formed on the first attachment surface and the oil outlet port communicates with the second closed area formed on the first attachment surface. The adaptor is attached to the attachment seating surface of the crank case such that an oil supply port formed on the attachment seating surface of the crank case is positioned within the first closed area and that an oil return port formed on the attachment seating surface of the crank case is positioned within the second closed area.

[0013] In a preferable example, the crank case to which the oil filter unit is attached has a first crank case and a second crank case separable from each other, and the adapter attachment seating surface of the crank case is disposed substantially perpendicular to the connection plane between the first crank case and the second crank case.

[0014] In a preferable example, the crank case to which the oil filter unit is attached has a cylinder head, the oil return port has a first oil return port and a second oil return port, the first oil return port communicates with a main gallery provided within the crank case via a first oil passage, and the second return port communicates with the cylinder head via a second oil passage.

[0015] In a preferable example, the second attachment surface is inclined with respect to the first attachment surface.

[0016] In a preferable example, the main gallery provided within the crank case to which the oil filter unit is attached is disposed parallel to the connection plane between the first crank case and the second crank case, and an oil supply passage communicating with the oil supply port formed on the attachment seating surface of the crank case and an oil return passage communicating with the oil return port formed on the attachment seating surface of the crank case extend at right angles relative to the main gallery.

[0017] A motorcycle according to one embodiment of the invention includes the above oil filter unit.

[0018] Aspects of the invention also relate to an adaptor for attaching an oil filter to an attachment seating surface of a crank case, which adaptor may incorporate some or all of the various preferred features described above.

[0019] Other aspects of the invention relate to a method of attaching an oil filter to a crank case via an adaptor. The adaptor may be first attached to the crank case, or may be first attached to the oil filter. In an oil filter unit according to an embodiment of the invention, the route of lubricating oil extending from an oil pump through an oil filter to a main gallery can be easily formed by attaching the oil filter to an attachment seating surface of a crank case via an adaptor. In this case, a first closed area and a second closed area formed on a first attachment surface of the adaptor forms an oil route communicating with the oil supply port and an oil return port formed on the attachment seating surface of the crank case.

[0020] According to this embodiment of the invention, therefore, the positions of the oil route connection ports (oil supply port and oil return port) formed on the crank case can be separated from the positions of the oil route connection ports (oil inlet port and oil outlet port) formed on the oil filter by providing the desired oil route extending from the oil passage of the crank case to the oil filter within the adaptor.

[0021] Accordingly, the oil filter unit provided according to embodiments of the invention facilitates formation of the oil passages within the crank case at low manufacturing cost regardless of the attachment position of the oil filter without requiring complicated structure of the oil passages.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] An embodiment according to the invention is hereinafter described with reference to the appended drawings. For simplifying the explanation, similar reference numerals are given to components having substantially similar functions in the figures. The invention is not limited to the following embodiment.

Fig. 1 illustrates a motorcycle including an oil filter unit in an embodiment according to the invention.

Fig. 2 is a right side view of the oil filter unit in the embodiment according to the invention.

Fig. 3 is a bottom view of the oil filter unit in the embodiment according to the invention.

Fig. 4 is a front view of the oil filter unit in the embodiment according to the invention.

Fig. 5 (a) is a plan view of a first attachment surface of an adaptor in the embodiment according to the invention.

Fig. 5 (b) is a perspective view of a second attachment surface of the adaptor.

Fig. 6 (a) is a cross-sectional view taken along a line VI-VI in Fig. 5(a). Fig. 6(b) is a plan view as viewed from a direction shown by an arrow A in Fig. 6(a).

Fig. 7(a) is a left side cross-sectional view of a structure of an engine case (crank case) in the related art.

Fig. 7(b) is a right side cross-sectional view of the structure of the engine case in the related art.

DETAILED DESCRIPTION OF THE DRAWINGS

[0023] Fig. 1 illustrates a motorcycle 1 having an oil filter unit in the embodiment according to the invention. As shown in Fig. 1, a crank case 11 containing an engine 40 is suspended from a vehicle body frame 42. An oil filter 10 is disposed before the crank case 11 in such a position as not to interfere with an exhaust pipe 41 extending from the cylinders of the engine 40 toward the rear or other components.

[0024] Next, a structure in which the oil filter unit according to the invention is attached to the crank case 11 is discussed with reference to Figs. 2 through 4. Fig. 2 is a right side view, Fig. 3 is a bottom view, and Fig. 4 is

a front view of the oil filter unit.

[0025] As illustrated in Fig. 2, the crank case 11 is constituted by a first crank case 11a and a second crank case 11b separable from each other. An oil pan 13 is attached to the lower part of the second crank case 11b. An oil filter 10 is attached to the front face of the second crank case 11b. While the oil filter 10 is attached thereto via an oil cooler 12 in this embodiment, the oil filter 10 may be directly attached without interposition of the oil cooler 12.

[0026] As illustrated in Figs. 2 and 3, lubricating oil stored in the oil pan 13 is pumped up by an oil pump 15 equipped on the second crank case 11b, and is supplied with pressure to the oil filter 10 via an oil pump-up passage 20 and an oil supply passage 21. Then, the lubricating oil filtered by the oil filter 10 is sent with pressure to a main gallery 22 via an oil return passage 25, and is supplied with pressure to the respective lubrication sections of the engine.

[0027] Next, the route of lubricating oil flowing from the oil supply passage 21 through the oil filter 10 to the main gallery 22 is discussed with reference to Figs. 3 and 4.

[0028] As illustrated in Figs. 3 and 4, the oil filter 10 is attached to an attachment seating surface 43 of the crank case 11 via an adapter 30. The adapter 30 has a first attachment surface 30a attached to the attachment seating surface 43 of the crank case, and a second attachment surface (not shown) attached to the oil filter 10. The first attachment surface 30a has a first closed area 31 and a second closed area 32 partitioned from each other by a partitioning wall 35. The second attachment surface has an oil inlet port 33 through which oil is introduced to the oil filter 10, and an oil outlet port 34 through which oil is discharged to the crank case 11.

[0029] The oil inlet port 33 communicates with the first closed area 31 via a communication path (not shown) formed within the adapter 30. The oil outlet port 34 communicates with the second closed area 32 via a communication path (not shown) formed within the adapter 30.

[0030] As illustrated in Fig. 4, an oil supply port 23 provided on the attachment seating surface 43 of the crank case 11 is positioned within the first closed area 31 of the adapter 30. An oil return port 24 provided on the attachment seating surface 43 of the crank case is positioned within the second closed area 32 of the adapter 30.

[0031] In the oil filter unit having the above structure, the route of lubricating oil extending from the oil pump 15 through the oil filter 10 to the main gallery 22 can be easily formed by using the first closed area 31 and second closed area 32 provided on the first attachment surface 30a of the adapter 30 as the oil route reaching the oil supply port 23 and oil return port 24 formed on the attachment seating surface 43 of the crank case 11.

[0032] More specifically, according to the above structure, the positions of the oil route connection ports (oil supply port 23 and oil return port 24) formed on the crank case 11 can be separated from the positions of the oil route connection ports (oil inlet port 33 and oil outlet port 34) formed on the oil filter 10 by providing the desired oil route extending from the oil passage of the crank case 11 to the oil filter 10 within the adaptor 30 in advance.

[0033] In the above structure, the attachment seating surface 43 of the crank case 11 is disposed substantially perpendicular to a connection plane 50 between the separable first and second crank cases 11a and 11b. Thus, the main gallery 22 within the crank case 11 is disposed parallel with the connection plane 50 between the first and second crank cases 11a and 11b, and the oil supply passage 21 communicating with the oil supply port 23 formed on the attachment seating surface 43 of the crank case 11 and the oil return passage 25 communicating with the oil return port 24 formed on the attachment seating surface 43 of the crank case 11 cross the main gallery 22 at right angles. Therefore, the oil filter unit can be attached while maintaining the structure where the respective oil passages within the crank case 11 intersect or cross one another at right angles. Since complicated structures are not required for the oil passages, the processing for forming the oil passages and the attachment seating surface 43 of the crank case 11 can be easily performed. Thus, the oil filter unit capable of securely forming oil passages at low manufacturing cost regardless of the attachment position of the oil filter can be provided.

[0034] Next, the structure of the adaptor 30 equipped on the oil filter unit according to the invention is discussed with reference to Figs. 5 (a), 5 (b), 6 (a), and 6 (b) . Fig. 5 (a) is a plan view of the first attachment surface 30a of the adaptor 30, and Fig. 5(b) is a perspective view of the second attachment surface 30b of the adaptor 30. Fig. 6 (a) is a cross-sectional view taken along a line VI-VI in Fig. 5(a), and Fig. 6 (b) is a plan view as viewed from a direction shown by an arrow A in Fig. 6(a).

[0035] As illustrated in Fig. 5(a), the first attachment surface 30a (surface to be attached to the attachment seating surface 43 of the crank case 11) has the first closed area 31 and the second closed area 32 separated from each other by the partitioning wall 35. As described above, when the adaptor 30 is attached to the attachment seating surface 43 of the crank case 11, the oil supply port 23 formed on the attachment seating surface 43 of the crank case 11 is positioned within the first closed area 31 and the oil return port 24 formed on the attachment seating surface 43 of the crank case 11 is positioned within the second closed area 32.

[0036] As illustrated in Fig. 5(a), the areas of the first closed area 31 and second closed area 32 are larger than the areas of the oil supply port 23 and oil return port 24. Thus, the oil supply port 23 and the oil return port 24 can be disposed at the predetermined positions of the crank case 11 with sufficient margins.

[0037] As illustrated in Fig. 5(b), the second attachment surface 30b (surface to be attached to the oil filter 10) has the oil inlet port 33 through which oil is introduced to the oil filter 10 and the oil outlet port 34 through which oil is discharged to the crank case 11.

[0038] As illustrated in Figs. 6(a) and 6(b), the oil inlet port 33 communicates with the first closed area 31 via the communication path formed within the adaptor 30, and the oil outlet port 34 communicates with the second closed area 32 via the communication path formed within the adaptor 30.

[0039] In this embodiment, the second attachment surface 30b is inclined with respect to the first attachment surface 30a. This structure allows the oil filter 10 to be attached with inclination to the attachment seating surface 43 of the crank case 11. Therefore, the oil filter 10 can be attached to the crank case 11 while avoiding interference of a hydraulic unit 16 (Fig. 3) attached to the front surface of the crank case 11, a radiator (not shown) and the exhaust pipe 41 (Fig. 1) disposed before the front surface of the crank case 11, and other components.

[0040] The invention is not limited to the preferred embodiment described and depicted herein, but various changes and modifications may be given to the invention. According to this embodiment, the adaptor 30 is attached to the attachment seating surface 43 of the crank case 11 such that the oil return port 24 (first oil return port 24a) communicating with the main gallery 22 via the oil return passage (first oil passage) 25 is located within the second closed area 32. However, the adaptor 30 may be attached to the attachment seating surface 43 of the crank case 11 such that an additional oil return port (second oil return port 24b) communicating with a cylinder head 14 within the crank case 11 via a second oil passage 37 is located within the second closed area 32 (see Figs. 2 and 4). In this case, the oil passages extending from the oil filter 10 to the main gallery 22 and the cylinder head 14 can be easily formed.

[0041] The motorcycle according to the embodiment refers to a vehicle which can turn to other directions while inclining its body, such as a motorbike or motor scooter. Thus, three-wheel vehicles, four-wheel vehicles and vehicles having more wheels which have two or more individual wheels collectively forming at least either a front wheel or a rear wheel set or unit and are classified based on the number of wheel sets or units are all included within the scope of the motorcycle according to the invention.

[0042] Thus, an oil filter unit provided according to embodiments of the invention can securely form oil passages at low manufacturing cost regardless of the attachment position of an oil filter.

DESCRIPTION OF REFERENCE NUMERALS AND SIGNS

[0043]

1	motorcycle
10	oil filter
11	crank case
11a	first crank case
11b	second crank case
12	oil cooler
13	oil pan
14	cylinder head
15	oil pump
20	oil pump-up passage
21	oil supply passage
22	main gallery
23	oil supply port
24	oil return port
24a	first oil return port
24b	second oil return port
25	oil return passage (first oil passage)
30	adaptor
30a	first attachment surface
30b	second attachment surface
31	first closed area
32	second closed area
33	oil inlet port
34	oil outlet port
35	partitioning wall
37	second oil passage
40	engine
41	exhaust pipe
42	vehicle body frame
43	attachment seating surface
50	connection plane
101	engine case (crank case)
101b	lower engine case
101a	upper engine case
102	oil pump
103	oil delivery passage
104	communication path
105	oil filter
106	oil supply passage
107	main gallery
108	oil pan

Claims

1. An oil filter unit, comprising:

an oil filter (10); and

an adaptor (30) for attaching the oil filter (10) to an attachment seating surface (43) of a crank case (11), wherein:

the adaptor (30) has a first attachment surface (30a) to be attached to the attachment seating surface (43) of the crank case and a second attachment surface (30b) to be attached to the oil filter (10);

the first attachment surface (30a) has a first closed area (31) and a second closed area (32) separated from each other by a partitioning wall (35);

the second attachment surface (30b) has

an oil inlet port (33) adapted to permit introduction of oil from an oil pump (15) and an oil outlet port (34) adapted to permit discharge of oil to an oil passage (25) formed in the crank case;
the oil inlet port (33) communicates with the first closed area (31) formed on the first attachment surface (30a) and the oil outlet port (34) communicates with the second closed area (32) formed on the first attachment surface; and
the adaptor (30) is adapted to be attached to the attachment seating surface (43) of the crank case such that an oil supply port (23) formed on the attachment seating surface of the crank case is positioned within the first closed area (31) and an oil return port (24) formed on the attachment seating surface of the crank case is positioned within the second closed area (32).

2. An oil filter unit according to claim 1, **characterized in that**:

the adaptor (30) is adapted to be attached to a crank case (11) having a first crank case (11a) and a second crank case (11b) separable from each other; and
wherein the adapter attachment seating surface (43) of the crank case is disposed substantially perpendicular to the connection plane (50) between the first crank case and the second crank case.

3. An oil filter unit according to claim 1 or 2, **characterized in that**:

the adaptor (30) is adapted to be attached to a crank case having a cylinder head (14);
the oil return port (24) of the crank case has a first oil return port (24a) and a second oil return port (24a);
the first oil return port (24a) communicates with a main gallery (22) provided within the crank case via a first oil passage (25); and
the second oil return port (24b) communicates with the cylinder head (14) via a second oil passage (37).

4. An oil filter unit according to claim 1, 2 or 3, **characterized in that** the second attachment surface (30b) is inclined with respect to the first attachment surface (30b).

5. An oil filter unit according to claim 1, 2, 3 or 4, **characterized in that**:

the adaptor (30) is adapted to be attached to a crank case (11) having a first crank case (11a) and a second crank case (11b) separable from each other and a main gallery (22) provided within the crank case disposed parallel to the connection plane (50) between the first crank case and the second crank case; and
an oil supply passage (21) in the crank case communicating with the oil supply port (23) formed on the attachment seating surface (43) of the crank case and an oil return passage (25) communicating with the oil return port (24) formed on the attachment seating surface (43) of the crank case are at right angles to the main gallery (22).

6. An adaptor (30) for attaching an oil filter (10) to an attachment seating surface (43) of a crank case (11), wherein:

the adaptor (30) has a first attachment surface (30a) to be attached to the attachment seating surface (43) of the crank case and a second attachment surface (30b) to be attached to the oil filter (10);
the first attachment surface (30a) has a first closed area (31)and a second closed area (32) separated from each other by a partitioning wall (35);
the second attachment surface (30b) has an oil inlet port (33) and an oil outlet port (34); and
the oil inlet port (33) communicates with the first closed area (31) formed on the first attachment surface (30a) and the oil outlet port (34) communicates with the second closed area (32) formed on the first attachment surface (30a).

7. An oil filter unit according to any of claims 1 to 5, or an adaptor according to claim 6, in combination with a crank case (11).

8. A motorcycle (1) including the oil filter unit or adaptor (30) according to any one of claims 1 through 7.

9. A method of attaching an oil filter to a crank case, the method comprising:

providing an adaptor having a first attachment surface and a second attachment surface, the first attachment surface having a first closed area and a second closed area separated from each other by a partitioning wall, the second attachment surface having an oil inlet port and an oil outlet port, the the oil outlet port communicating with the second closed area;
attaching the first attachment surface of the adaptor to an attachment seating surface of a crank case such that an oil supply port formed on the attachment seating surface of the crank

case is positioned within the first closed area and an oil return port formed on the attachment seating surface of the crank case is positioned within the second closed area; and

attaching an oil filter to the second attachment surface of the adaptor the such that the oil inlet port permits introduction of oil to the oil filter from an oil pump and the oil outlet port permits discharge of oil from the oil filter to an oil passage formed in the crank case.

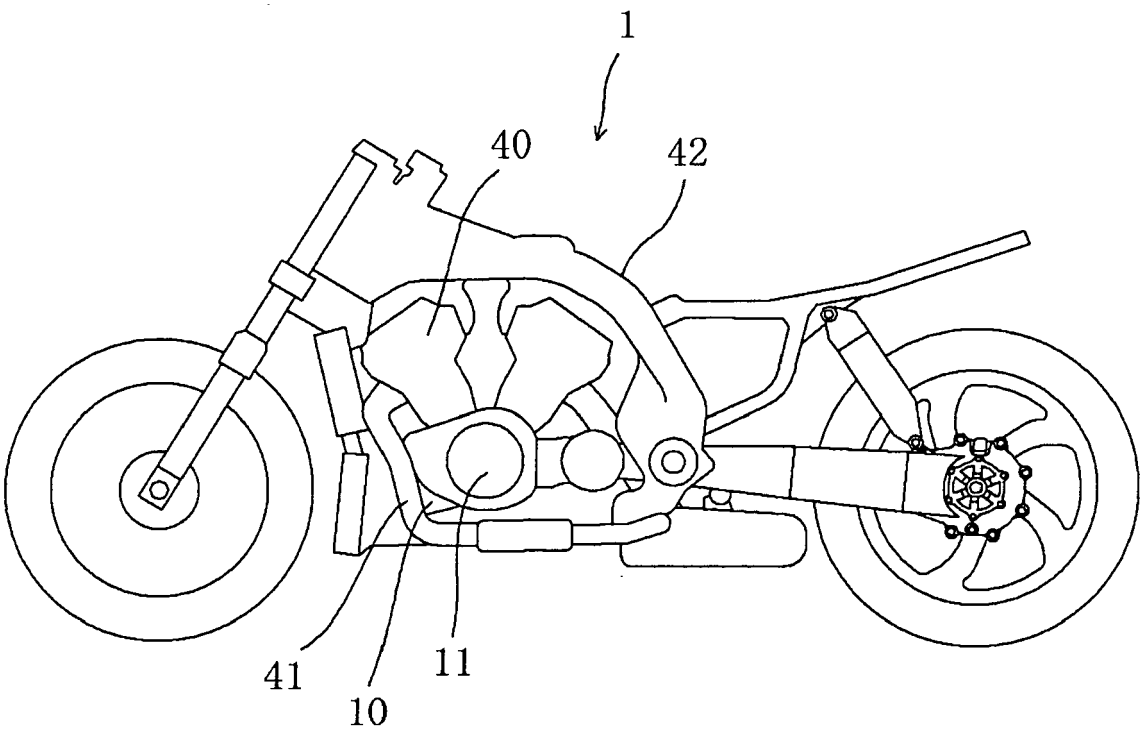

FIG. 1

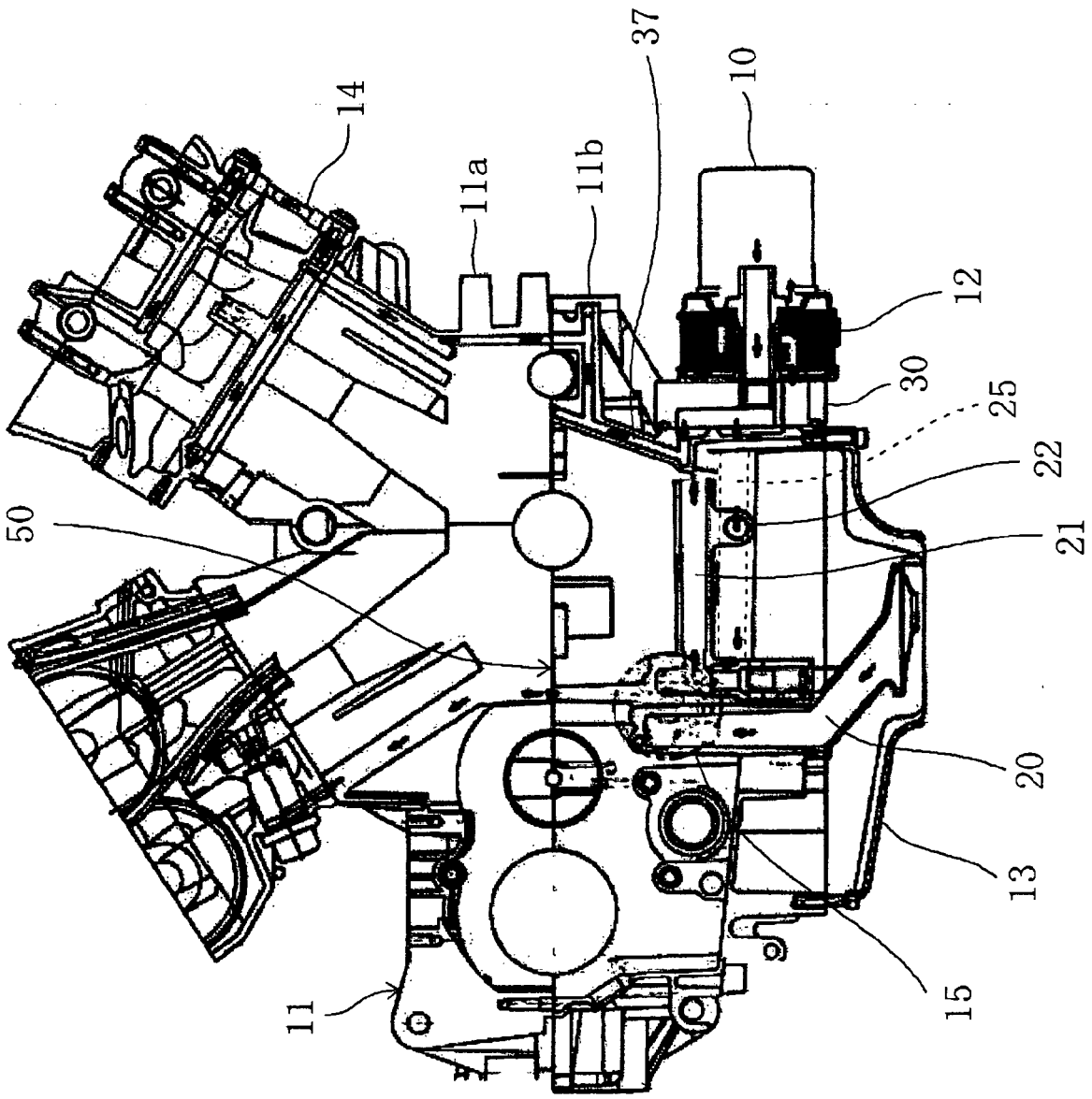

FIG. 2

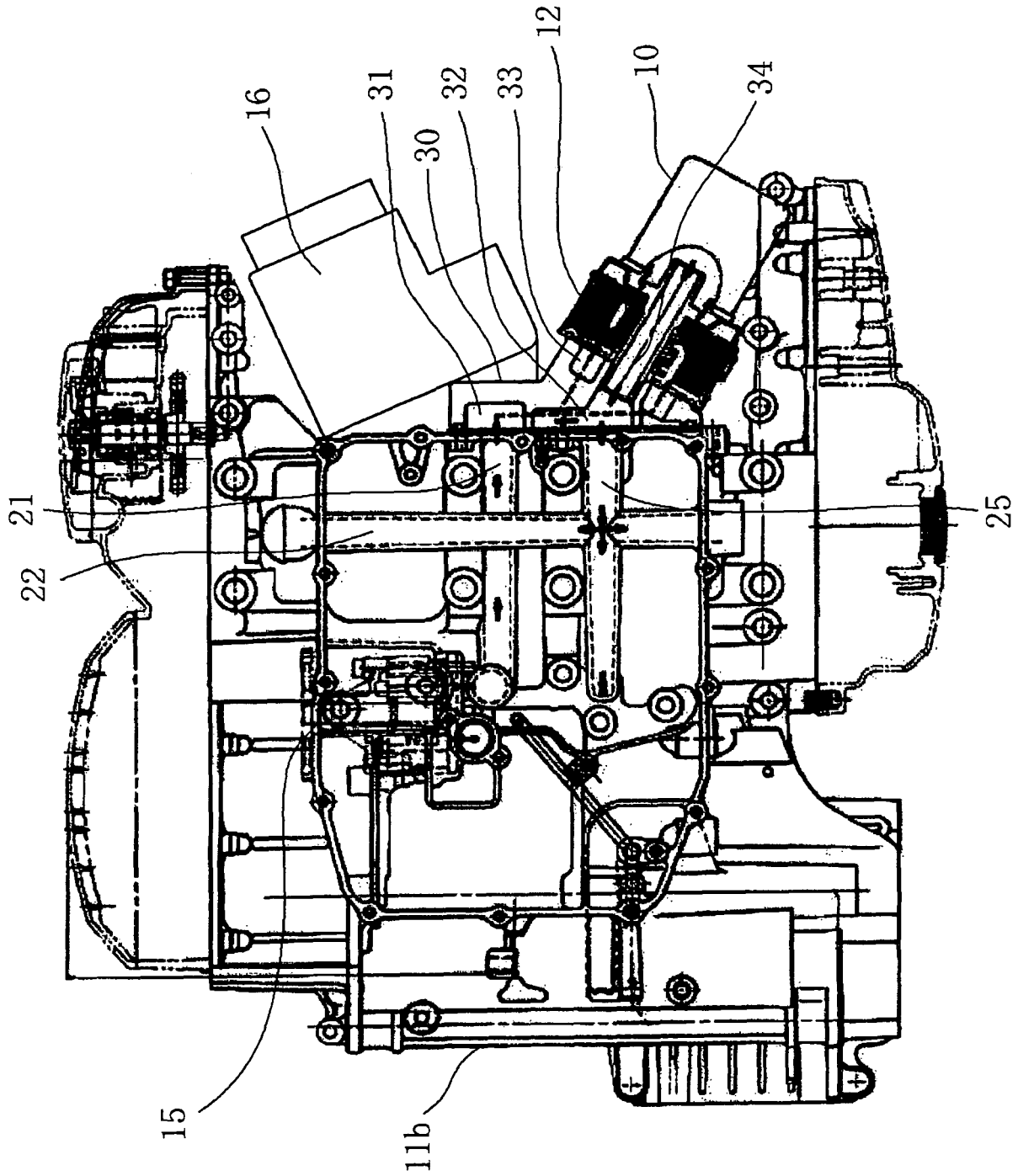

FIG. 3

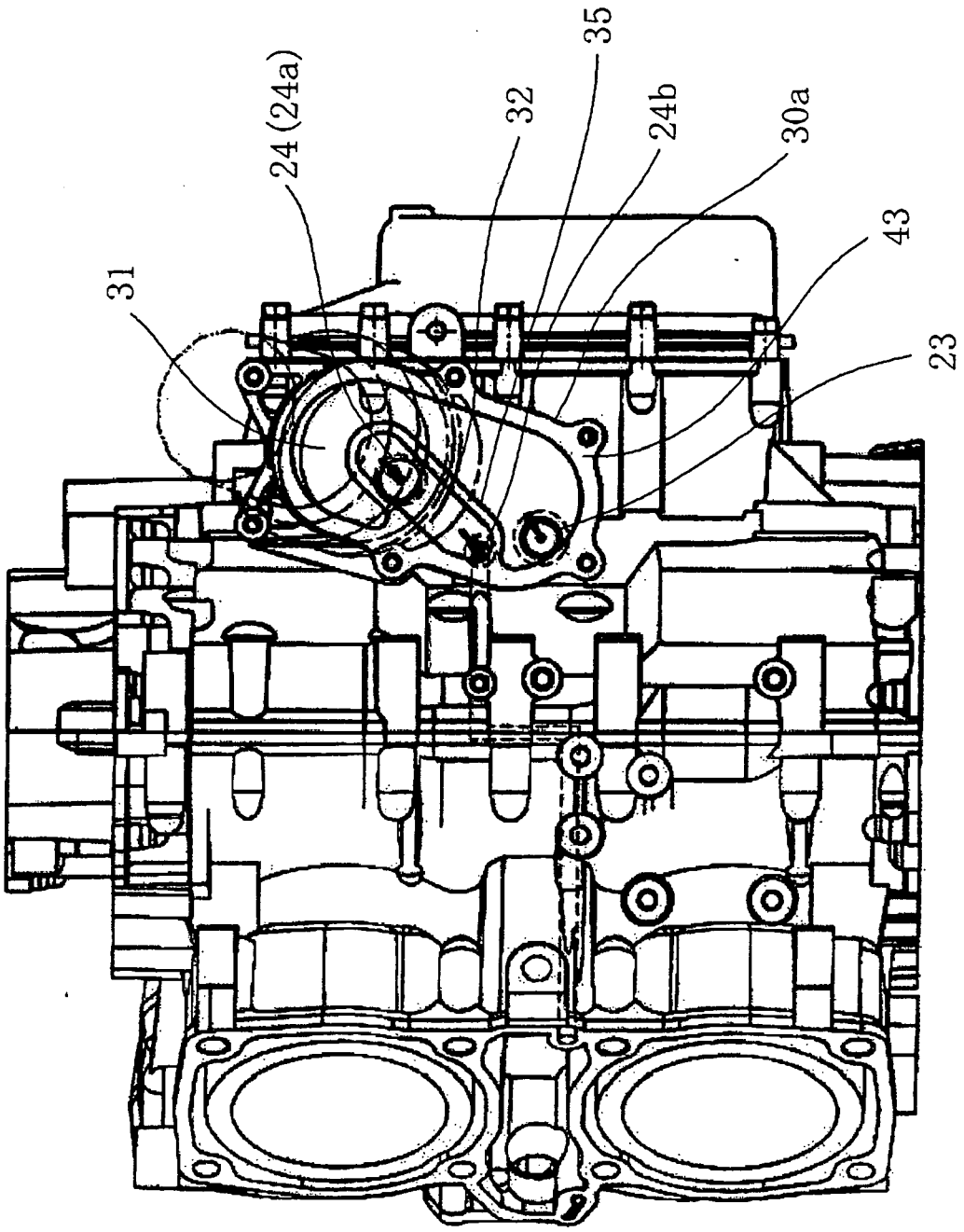

FIG. 4

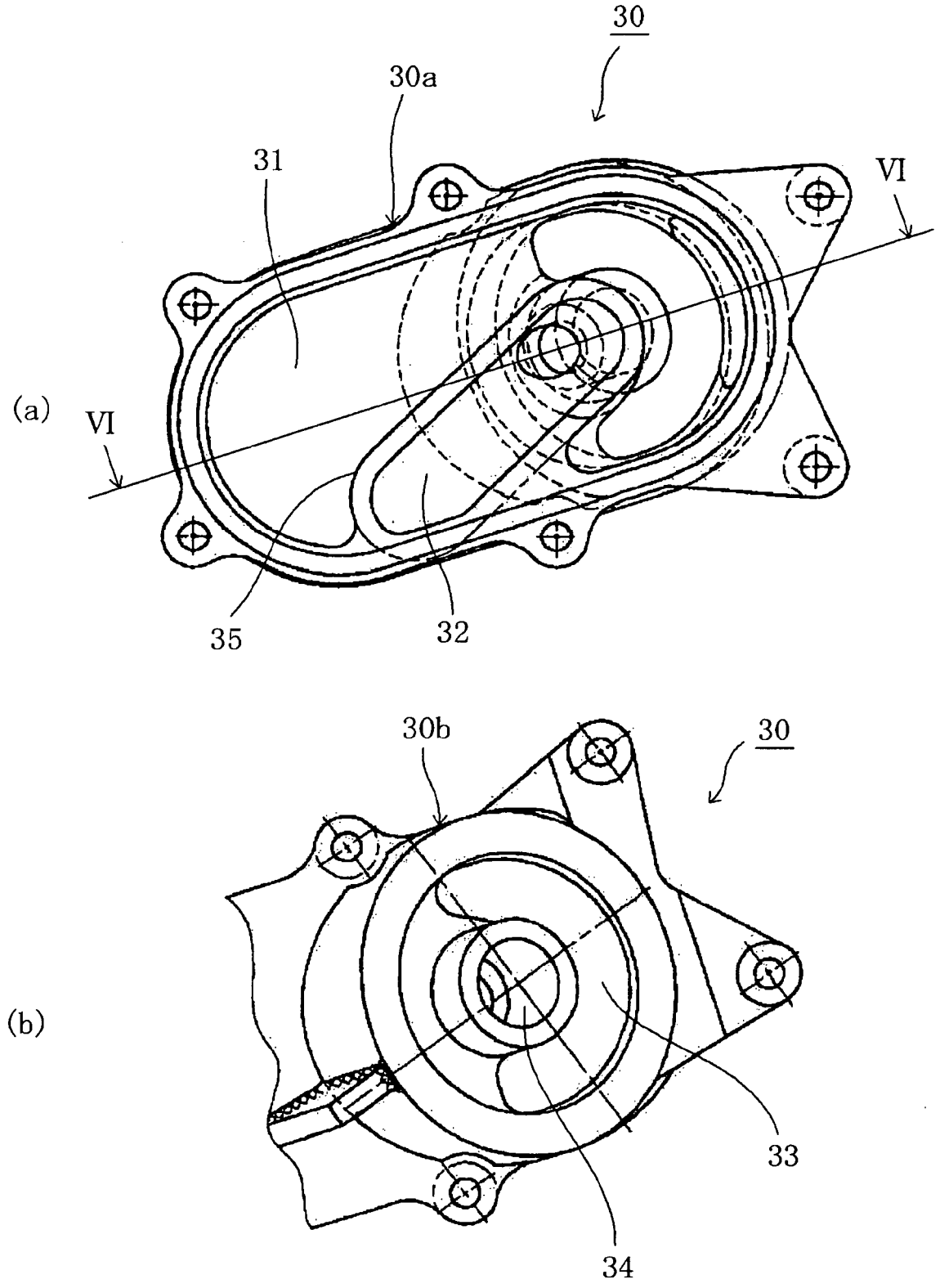

FIG. 5

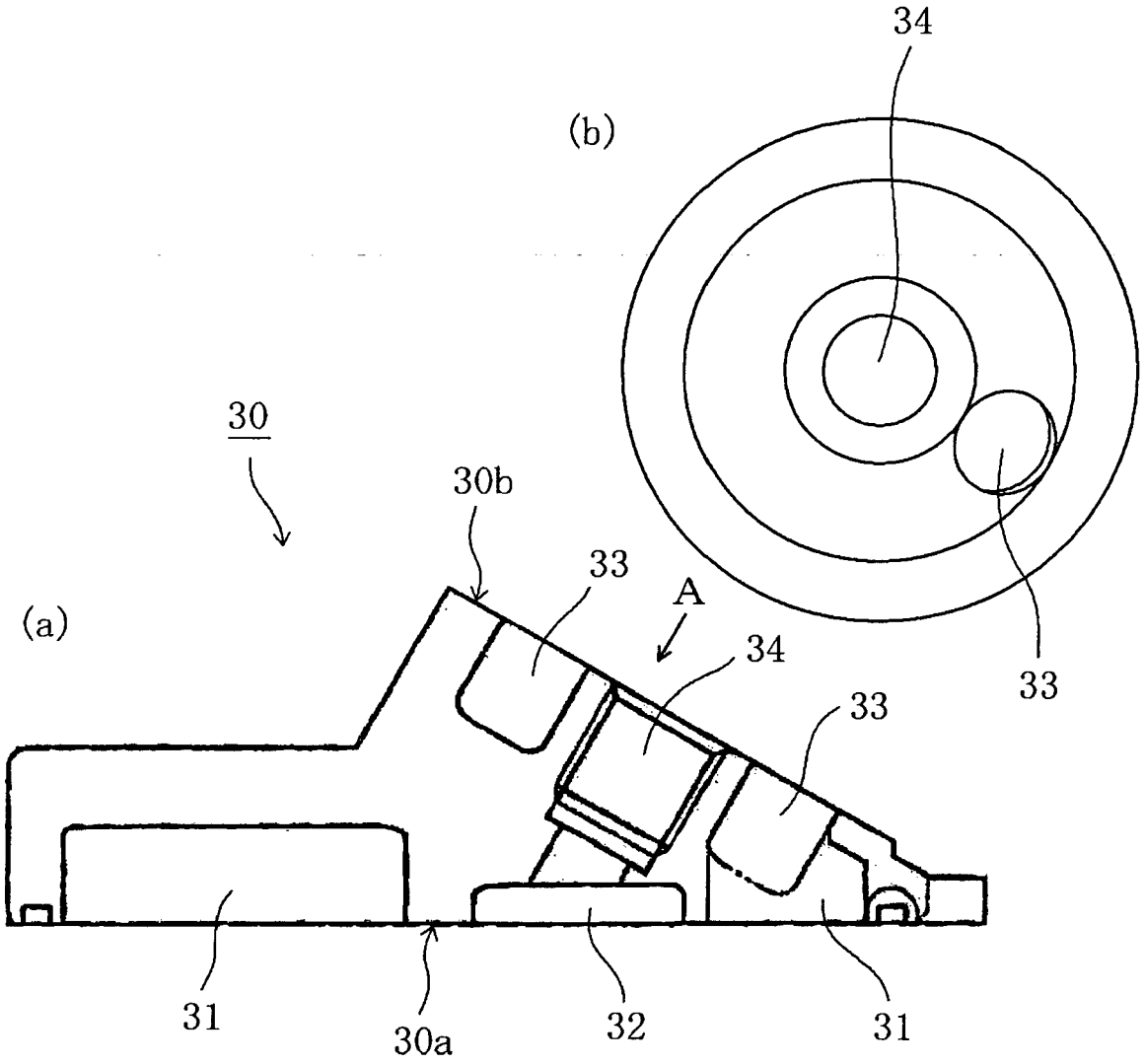

FIG. 6

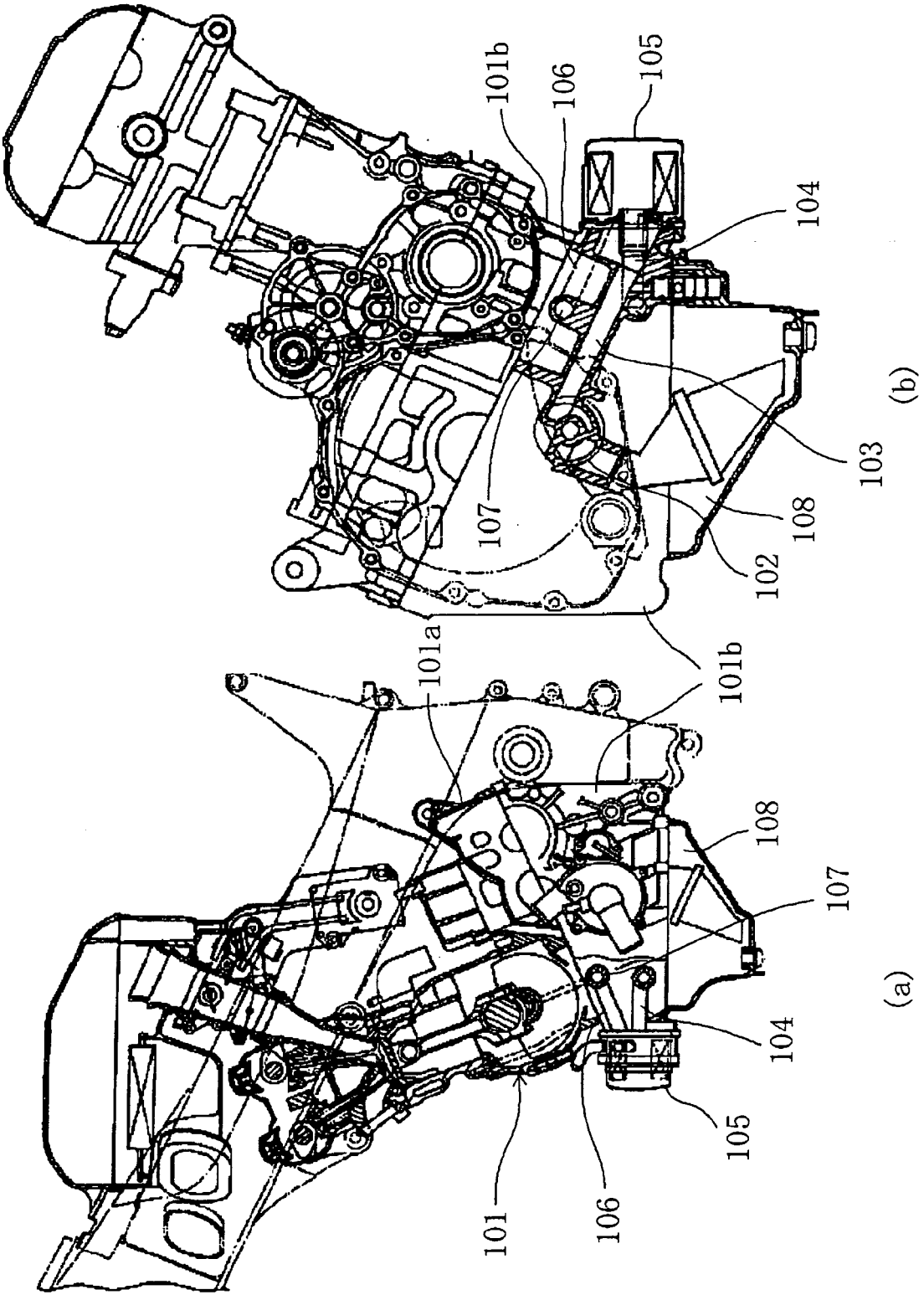
101b
106
105
104
103
(b)
107
108
102
101a
101b
108
107
104
105
101
106
(a)

FIG. 7

REFERENCES CITED IN THE DESCRIPTION

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